NRL VOCALS-Rex Effort

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NRL Modeling Efforts

- Aerosol-drizzle-cloud interaction

    - COAMPS real-time forecast (depending on computer resource)

    - Process studies using COAMPS and COAMPS-LES

    - Development and improvement of cloud and turbulence parameterizations

- Atmosphere-ocean-land coupling

    - NCOMS-COAMPS simulations

    - SST, upwelling and mesoscale eddies

COAMPS=Coupled Ocean/Atmosphere Mesoscale Prediction System

COAMPS

COAMPS

- Navy weather forecast model

- Recent improvement regarding stratocumulus cloud prediction

    - Cloud layer mixing length;

    - Fu-Liou radiation;

    - Khairoudinov and Kogan drizzle two-moment scheme

- Bin dust aerosol representation (no CCN)

Model Issues

- Stratocumulus coverage is usually under predicted.

- Mesoscale distribution of stratocumulus is particularly challenging.

- Aerosol source function for two-moment scheme in operation model

What contribute to the modeled stratocumulus cloud errors?

- **Evaluate COAMPS stratocumulus cloud forecast**

  - Large- and mesoscale dynamic parameters: SST, Wind and thermodynamic structure at 850 mb and above; vertical motion (?)

    C-130 soundings or drop sounds, buoys, and cross-section missions

  - Boundary layer (mean and turbulence) and cloud macrostructure

    C-130 soundings, turbulence legs, cloud measurements (LWP, CW), satellite data

  - Cloud microphysics, radiation

    C-130, twin-otter: small, large droplets, CCN spectrum

  - Mesoscale distribution

    C-130 cross-section and drifted missions, buoys, Satellite observations

 - Near coastal feature (BL height slope, topographic flow, low-level jet)

    Twin-Otter: sounding, turbulence legs

- **Analyze the bias and look for the link among the bias**

Planned COAMPS Real-Time Forecast

COAMPS real-time forecast (depending on computer resource and others)

- High-resolution: 3kmx9kmx27km (?)

- Twice daily 72 hours forecast for entire experiment

- NOGAPS (global model) provides lateral b.c.

- Provide as many variables as desired, e.g. cross section plots

- Dust aerosols

- Given the copper smelter emission rate – a tracer can be predicted to simulate the transport

VOCALS study region

- Data assimilation: SST from VOCALS Buoys; atmospheric soundings?

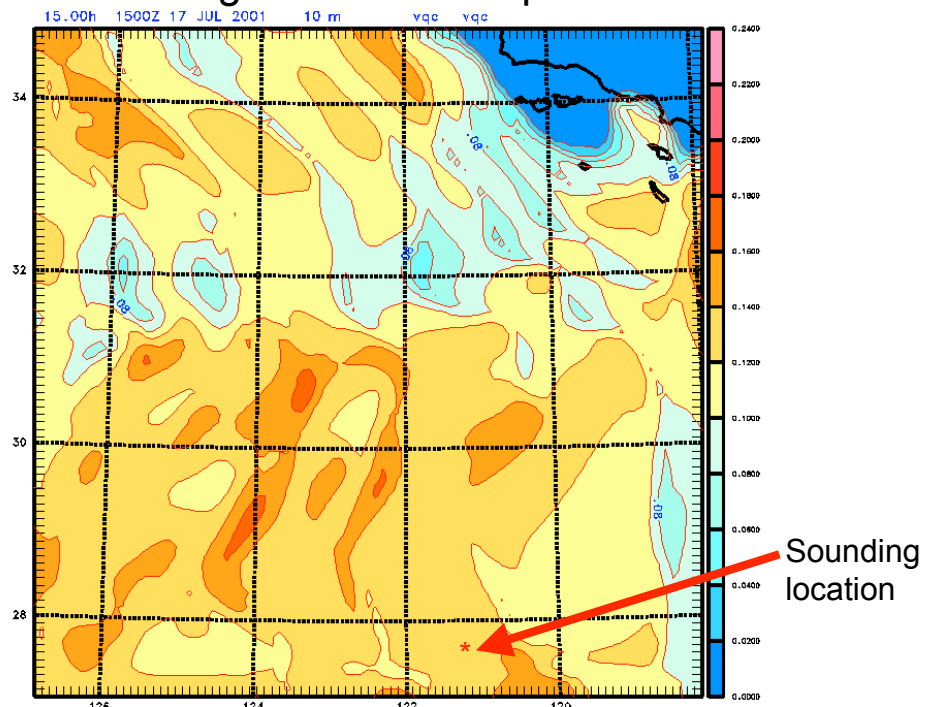- A coupled COAMPS-NCOMS?

- A pre-VOCALS simulation
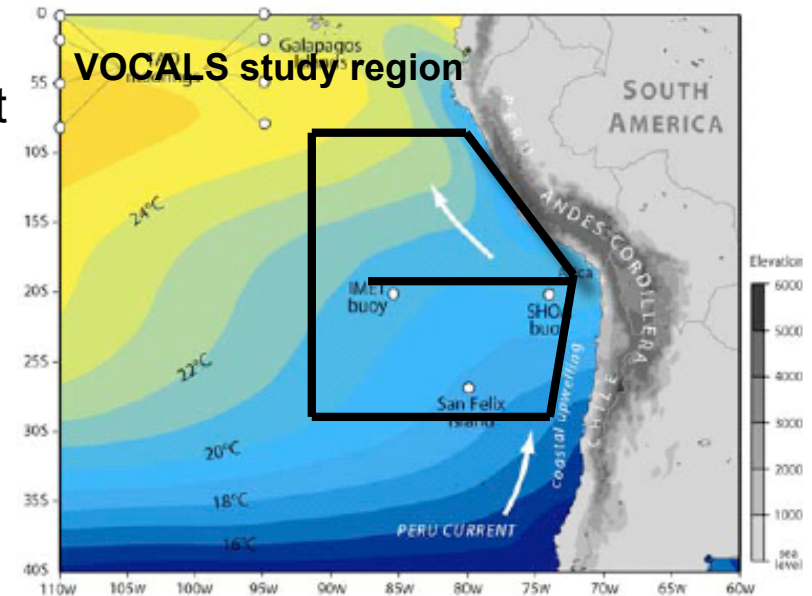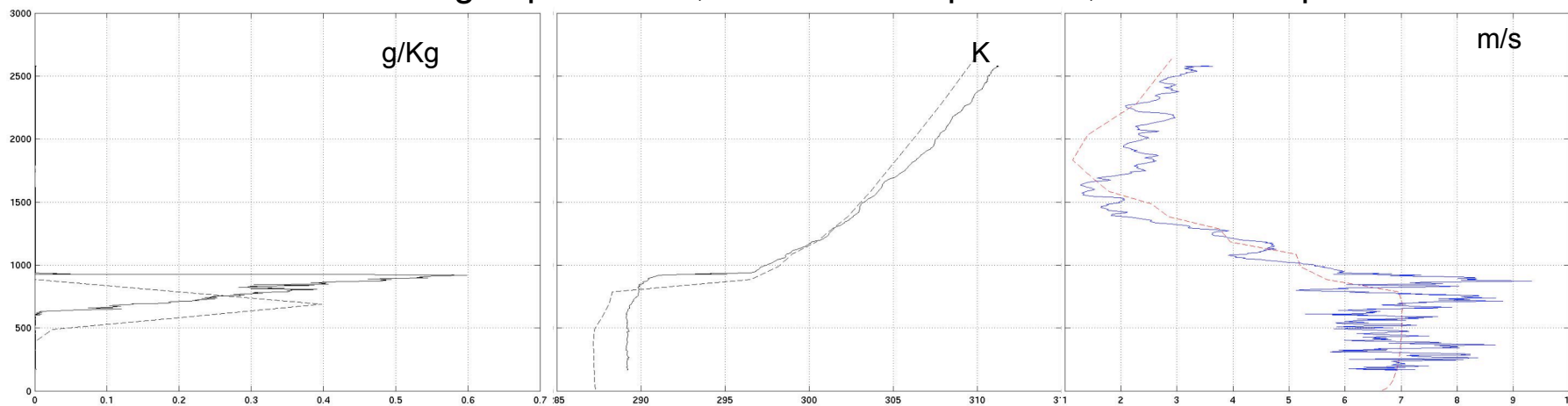
DYCOMS-II RF04 17 July 2001 Haack and Thompson

Satellite Liquid Water Path 1445 UTC
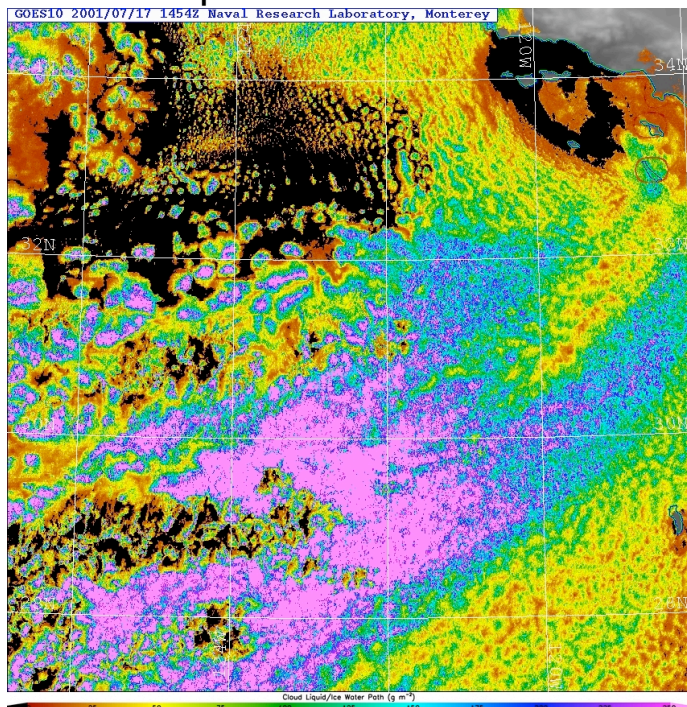
COAMPS Integrated Cloud Liquid Water 1500 UTC

Sounding location

Aircraft Sounding Liquid Water, Potential Temperature, and Wind Speed 1400 UTC
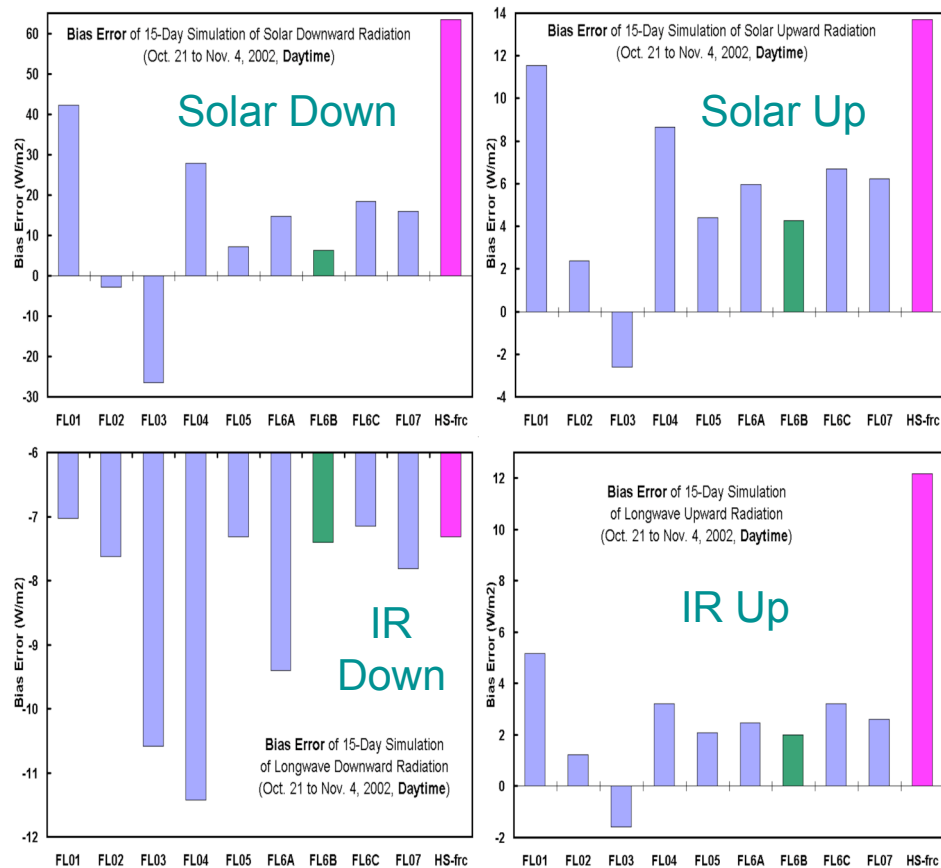
Evaluation of Fu-Liou RT model in COAMPS

Comparison of various cloud & ice effective-radius schemes in Fu-Liou
and **Comparison** of Fu-Liou with COAMPS **Standard** RT model
Verification at ARM SGP surface station in **15 Cloud Days** (Oct. 21 to Nov. 4, 2002)

(1) Daytime BIAS errors of radiative fluxes

*Grid 9-km fluxes are verified. **FL#** are various combinations
of cloud and ice parameterizations, among which **FL6b**
performances the best. **HS-frc** is COAMPS standard model.

(M, Liu)

Drizzle-cloud-turbulence interaction

• **COAMPS-LES simulations of 3 cloud cases: non-drizzle, drizzle without drizzle evaporation, drizzle.**

• **The evaporation is the forcing for the turbulence and cloud structural change.**

• **The bulk-cloud model does not include the dynamic feedback of the condensation relaxation time scale.**